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Intellectual Property Office of New Zealand
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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 12 March 1999 with an application for Letters Patent number 334620 made by WOOL RESEARCH ORGANISATION OF NZ INCORPORATED.

Dated 23 February 2000.

Neville Harris
Commissioner of Patents

334620

Patents Form No. 4 Our Ref: RL801937

Patents Act 1953

PROVISIONAL SPECIFICATION

NON-SIMPLE HARMONIC MOTION NEEDLEBAR

We, **WOOL RESEARCH ORGANISATION OF NEW ZEALAND (INC.)**, an incorporated society under the laws of New Zealand, of Cnr Springs Road & Gerald Street, Lincoln, Canterbury New Zealand do hereby declare this invention to be described in the following statement:

PT0490856

NON-SIMPLE HARMONIC MOTION NEEDLEBAR

FIELD OF THE INVENTION

The invention relates to the action of the needlebars of tufting machines, the action of the needlebars being adapted to give improved pick up performance and greater control of needle action by non-simple harmonic motion of the needlebars.

BACKGROUND TO THE INVENTION

The action of a needlebar in a tufting machine is controlled by a main drive. Usually the drive is direct coupled and, although antivibration decoupled drive systems have evolved out of recent research to develop high speed tufters, to the best of the applicants knowledge all needlebars follow a simple harmonic motion, oscillating between top-dead-centre(TDC) and bottom-dead-centre(BDC).

The pick-up of yarn off the needle is a critical part of a tufting action which is best achieved slightly after the needle has passed BDC. Halting, or slowing the needle at this point would assist the looper yarn pick-up.

In the case of double-sliding needlebar tufters, excess top stroke is required to enable the lateral needlebar shifts to take place and avoid backstitch "tagging" as the needle moves down toward BDC. This can result in loose and uneven backstitches. Similarly, excess bottom stroke is also required to enable clean pick-up of the yarn from both the front and back needlebars. This can cause problems with evenness of the pile surface.

Adjustment of the top and bottom needlebar stroke influences the surface and the back-stitch of a tufted carpet. The means of adjustment of current needlebar strokes are generally very crude and often involving (sometimes non-ideal) quantum step adjustments.

Although intermittent feed of the primary backing is possible with modern tufting machines this is generally not used. Instead the backing is moved in a continuous fashion, ie for at least some of the needle stroke with the needle still in the backing. This system causes stresses on both the tufting machine and carpet primary backing. The stresses on the machine cause, for example, increased power usage and premature machine wear. The stresses on the carpet backing cause distortion of the structure of the primary backing which in turn can lead to problems with, for example, carpet dimensions. In the case where intermittent primary backing feed was used, the time available for backing feeding is limited.

An object of the invention is to overcome the identified disadvantages, provide an alternative choice and improve needle action and performance.

Further objects of the invention will become apparent from the following descriptions.

SUMMARY OF THE INVENTION

According to a broadest aspect of the invention there is provided a tufting machine in which the needle action is a non-simple harmonic motion.

A non-simple harmonic action (n-SHM) needlebar action would also have significant advantages.

Mechanical systems (e.g. cams) can be used to achieve an n-SHM needle action with significant improvements in comparison to conventional needlebar actions. The greatest advantages for a n-SHM needlebar drive system would be achieved through the use of a computer controlled drive system.

PREFERRED EXAMPLES

A comparison between conventional simple harmonic needle action and the non-simple harmonic needle action of the present invention is shown in the accompanying drawing in which:

Figure 1 shows conventional simple harmonic motion needle and looper action.

Figure 2 shows an example of path for the non-simple harmonic motion for a needle with the (SHM) looper path shown as well.

In Figure 1 the needle oscillates between top dead centre (TDC) and bottom dead centre (BDC) with a SHM. The looper oscillates between fully extended and fully retracted with a SHM.

Using a n-SHM needlebar action would enable the needle to be slowed, or halted, at the pick-up point to assist the looper to pick up the yarn from the needle.

A n-SHM needlebar action could also be used to reduce the amount of time that the needle is in the backing (as a percentage of the total needle stroke time) which

would lead to reduced stress on the tufting machine and reduced distortion of the carpet primary backing.

Although in theory it is possible to vary the distance between rows of tufts (ie stitch rate), in practice there is a practical limit on the extent of variation for any given top stroke setting of the needlebar, ie limited by the time that the needles are out of the backing. Using an n-SHM needlebar action, the needles could be slowed, or halted, above the backing to extend the time avaliable for increased distance between rows of tufts.

In the case of intermittent primary backing feeding, a n-SHM needlebar action would allow more time for the backing advance to take place, ie when the needle was not in the carpet backing.

In the case of double sliding needlebar tufting machines an n-SHM needlebar action which slowed, or halted, the needle at TDC could be used to ensure that the needles would not "tag" the backstitches without excess top stroke which would, in turn, result in tighter, more even backstitches. Furthermore, the use of an n-SHM needlebar action which slowed, or halted, the needle at the pick-up could be used to ensure good yarn pick-up without excess bottom stroke which would, in turn, result in a more even carpet surface.

A computer controlled needlebar drive system would also enable the action to be electronically fine-tuned to a high level of precision. Different set ups could be achieved automatically for a different product as is currently done for other tufting

parameters, such as yarn feed, pile height, primary backing feed, etc, as in US 4867080.

Patterning effects may also be possible through variation of the needlebar stroke between rows of the same product.

It is expected that a n-SHM needlebar action would also lead to reduced machine vibration, which in turn, could enable higher speed operation. Further advantages could also be accrued through the use of shorter needlebar strokes and intermittent needlebar action.

Where in the foregoing description particular reference has been made to mechanical equipment it is envisaged that their mechanical equivalents can be substituted as if they were individually set forth.

Thus by this invention there is provided a tufting machine in which the motion of its needles is non-simple harmonic motion.

Particular examples of the invention have been described and it is envisaged that improvements and modifications can take place without departing from the scope thereof.

WOOL RESEARCH ORGANISATION
OF NEW ZEALAND (INC.)
By Their Attorneys

BALDWIN SHELSTON WATERS

Fig. 1 Conventional Simple-Harmonic-Motion Needle and Looper Action

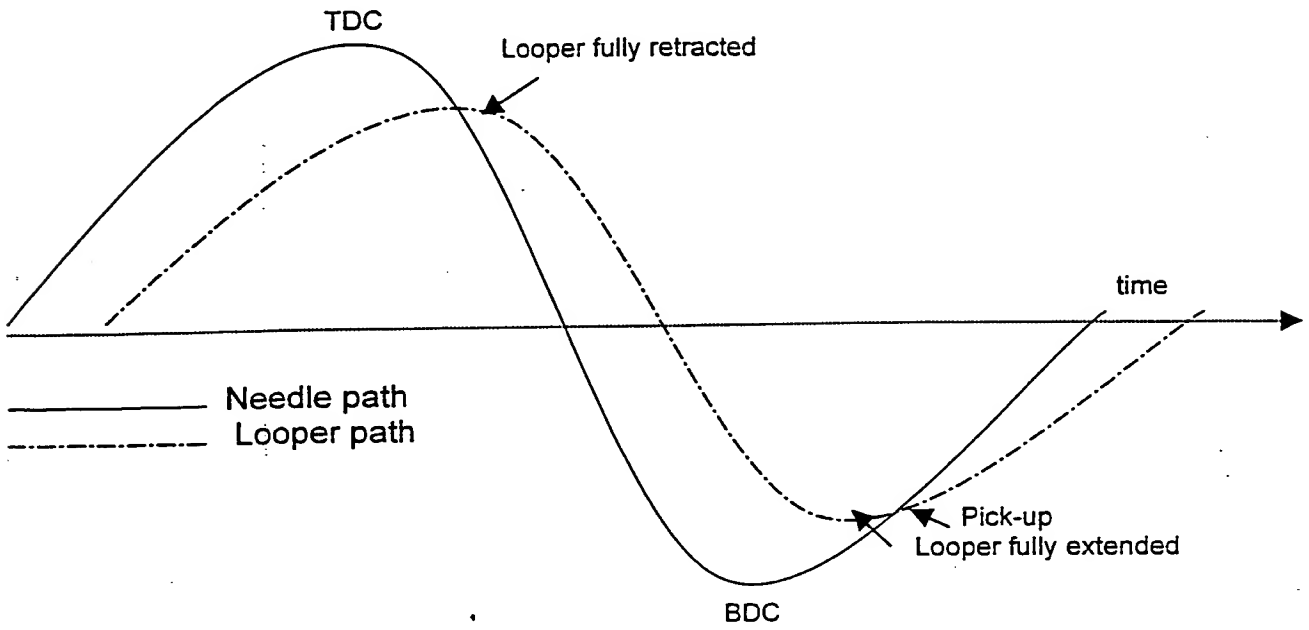
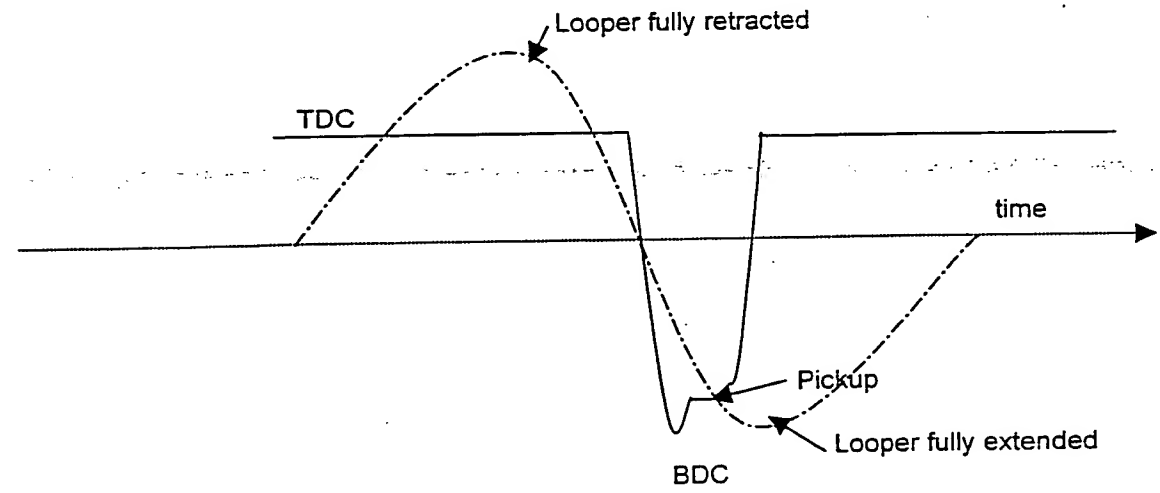


Fig. 2 New Non-Simple-Harmonic-Motion Needle/conventional SHM Looper



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